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a. General Observations.

in the USSR (1946-1952) was a period of fast and radical changes in Soviet electronics and the period of the growth of Soviet electronics facilities and capabilities which is probably without parallel anywhere. During this time new concepts of organization, planning and programming, training, laboratory and production techniques were evolved, experimented with, and put into operation. Some of these were found faulty and were rejected, some were modified and accepted, some are still under test. Many Soviet research developments and production institutes, like #160 at Fryazino, were started with virtually no facilities, no experience and no manpower, and grew into large and effectively operating organizations. In 1945/46 Admiral Berg and other Soviet leaders admitted that they had good basic scientists, some good managers and mechanics, but virtually no "practical" engineers.

By 1952 the same men concluded that they had reached the point where they did not need to depend upon further German assistance, and had enough native engineering forces at all levels for their needs.

Under such rapidly changing conditions /1946-52/ it is possible to find good arguments to support any conclusion in regard to Soviet electronics progress and in regard to Soviet electronics specialists and their capabilities.

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b. Soviet Leaders in Electronics.

(1) "The Soviet electronics leaders [redacted]

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[redacted] first-rate men and would be a good asset in any country. They were capable leaders and managers, had high organizing ability, and were top men in their specialized substantive fields of activities. They had a sound and realistic grasp of the Soviet problems, needs, weaknesses and strength, and worked hard to make the best use of the human and physical resources available to them. Most of them had direct personal contacts at the highest levels of the Soviet hierarchy, were well supported by these and though not on the purest Party-line political orientation were able to handle their semi-political jobs, at the high levels of responsibility, with sufficient acumen to keep out of trouble. It is essentially to these men, with their foresight and managerial ability that the Soviets owe the tremendous post-war growth of their electronics capability and the soundness of the bases for further progress.

(2) "A list of these high-level Soviet specialists-administrators would include the following individuals [redacted]

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- (a) "Admiral Berg (Ret), member of the Soviet Academy of Sciences and Scientific Director of Institute 108 in Moscow.

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- (b) "Captain A N Shchukin. Naval Engineer 1st Grade.

- (c) "Lt General (fnu) Belyakov, Chief of the Navigational School of the Soviet Air Force,

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- (d) "Professor (fnu) Stillermann, the senior scientist on General Belyakov's staff

- (e) "(fnu) Zuzmanovskiy, formerly Scientific Director of Institute 160,

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- (f) "Major (fnu) Cheletnin.

- (g) "(fnu) Katzmann, formerly chief engineer of Second Main Administration group of MCEI,

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- (h) "(fnu) Devyatkov, Scientific Director of Institute 160 in Frvazino,

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- (i) "(fnu) Yelisarov, chief engineer of the Second Main Administration group of MCEI between 1947-1951;

- (j) "(fnu) Sorokin, presently Chief engineer of the Second Administration group of MCEI.

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- (k) "(fnu) Lippsmann, Scientific Director of Moscow Institute #20.

- (3) "Most of the above men are Soviet electronics 'oldtimers' whose capabilities were developed and applied during the abnormal World War II and post-war periods.

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the Soviets will be able to solve any serious problem in electronics as long as the field continues to enjoy its present high-priority command of Soviet efforts.

there is any doubt that suitable replacements for them will be forthcoming from the ranks of the younger Soviet engineers.

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c. Electronics Scientific Personnel.

- (1) [redacted] in spite of the pre-war degradation of Russian original work in science and technology [redacted] was the direct reason for the somewhat ridiculous efforts of the Soviets to claim credit for all important developments and inventions of the past, the Soviets have very able and qualified scientists fully capable of important and original discoveries. So far their primary interest has been in theoretical fields, simply because the majority of Soviet university graduates have been trained strongly in theory and have been weak in practical applications. The Soviet Union's present needs, and consequent stress on technological applications, will change this. Will original Soviet endeavors be sufficient to meet their current and future needs?

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[redacted] all ills carry in them the seeds of remedy, and perhaps the Soviets will find their own solutions to their problems in the future as they did in the past.

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- (2) "Many of the present Soviet electronics scientists are oldtimers in the same sense as their electronics leaders. The outstanding men, like Zuzmanovsky, Shchukin, Stillermann, Alekseyev, Zeitlin, are the product of the pre-war training and war-time and post-war experience. [redacted] a new generation of very capable scientists is coming into being. [redacted] Soviet graduates from Soviet technological institutes have a theoretical training as good as the Germans and [redacted] first-hand experience with such graduates at Fryazino convinces [redacted] there ought to be no lack of capable electronics scientists in the USSR. Of outstanding caliber are the products of the Moscow University*, of the Moscow Electrotechnical Institute /sic/, the Moscow Energetics Institute** and the Leningrad University*** and institutes. A very important role in training the young scientists is played by the Svetlana Institute.

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* /Moscow M V Lomonsov State University of the Order of Lenin/

** /Moscow V M Molotov Institute of Energetics of the Order of Lenin./

*** /A A Zhdanov State University of the Order of Lenin/

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- (3) "It is important to recognize that the traditional Soviet university training has always stressed pure science, even in such applied fields as electronics. It is also interesting to note that the Soviet candidate is fully equivalent to a German doctor's degree (and there are ever-increasing numbers of these in the USSR) and the Soviet degree of doctor has no exact counterpart [redacted] but is close to the German 'Doctor Habil' which is a high-level scientist in his field. [redacted] a sizable number of these in the USSR, therefore, the Soviets are not apt to be short of capable and original scientists in electronics."

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d. Soviet Electronics "Middle Class."

- (1) "[redacted] one of the outstanding Soviet accomplishments in electronics, management-wise, has been their ability to alleviate their most critical factor in electronics progress, namely a very severe shortage of capable 'middle class' or design, development and application engineers. [redacted] along with other German specialists, that upon [redacted] arrival in the USSR in 1946 that there were few Soviet application engineers on the jobs [redacted] and that these were much inferior to their German counterparts. [redacted] this was not the case [redacted] and that both the quality and quantity of such engineering forces have been steadily growing and will continue to grow. [redacted] in 10 years the Soviets will have as good 'middle class' engineers as will be found anywhere and in much larger numbers."

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- (2) [redacted] the original unfavorable German impression of Soviet applications engineers might have been biased, [redacted]

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The basic improvement came around 1950 when a large number of new university graduates began to appear in Fryazino and other institutes. [redacted] first-hand experience with these graduates who were assigned to my group as assistants and to whose plans for graduate training [redacted]

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[redacted] these men had excellent theoretical training, were well disciplined in team work, were hard working and once convinced of the value of laboratory work (work which their formal training did not provide them) were curious and capable students. [redacted] the average Soviet engineer to be very adaptable, keen on improvisations, somewhat stubborn in face of difficulties and not willing to give up if initially unsuccessful. A Soviet engineer is inclined to accept leadership too readily, but also anxious to prove his own abilities."

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- (3) "Contrary to the prevalent western opinion, a Soviet engineer is not severely restricted in his professional work. He is offered ready opportunity for pursuing his personal preferences and is assisted in determining these by his superiors. They are induced to develop home interest and projects in electronics, and those who so desire are permitted to draw upon components and materiel from their institutes for such hobbies as building home radio and television receivers, testing equipment, etc. Since opportunities for social activities are not overly rich in the USSR, a Soviet engineer has somewhat more free time than his western counterpart and spends more time on professional activities at home. In this he is supported by the ready availability of Soviet and foreign technical publications and by professional guidance of his senior scientists and

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engineers. In order to be able to use the foreign literature, study of languages is heavily favored, and those who study foreign languages benefit by receiving pay increases.

- (4) "The most capable of these engineers are offered an opportunity for advanced degree work while on-the-job. Their progress in these is carefully supervised and guided, and adequate time and funds are allotted to them for such activities.

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e. Lower-grade Technicians and Mechanics.

- (1) "[redacted] the Soviet mechanics and technicians although [redacted] the Soviet school training for these is not good by German standards (there is too much stress on book studies and not enough on shop technique). The general quality of these mechanics and technicians, after a few years on the job, is very good. They are not afraid of tackling any new job [redacted] several cases when a Soviet mechanic tackled a job successfully, which German mechanics and engineers refused to handle because of lack of background knowledge or experience. They are capable improvisers, hard workers and capable of sustained endeavor under conditions which would be intolerable to western counterparts. [redacted] a shortage of qualified mechanics in the USSR is apt to develop.

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f. Soviet Technical Training.

(1) Primary Schooling

- (a) "Soviet primary schooling starts at the age of seven and comprises 10 grades. Prior to 1950 only four years of primary schooling was compulsory, a minimum of seven years has been required since 1950. This system is at variance with that of the German in that the primary schooling in Germany totals 13 years, against the Soviet 10 years, and in the case of technical training one more year is required in Germany of field experience prior to entering a technical university or special institute (hochschule). Incidentally, the present Soviet system differs in the same regard with the old Russian system which was also based upon 12-13 years of preparatory schooling.
- (b) "A certain percentage of primary school students leave at the end of the seven-year compulsory training for technical or vocational schools. Those who remain are given preparatory training for the university education. During this period any student who does not show proper aptitude for university-level education is dropped from primary schooling. [redacted] Soviet observation in regard to students' capabilities during this period is quite close and effective.
- (c) "Graduates of the primary schools do not automatically enter universities or high-level technical schools but must pass an entrance examination. In addition, some outstanding universities, such as the Moscow University, require that only those who finish the primary education with top honors (gold medal) are permitted to participate in the university entrance examination. The gold medal, then, is a

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prerequisite for the entrance examination.

candidates for the Moscow University examinations are chosen from all primary schools throughout the USSR, and then only about a third or fourth of all gold-medalists enter the Moscow University. All others, and non-honor students can compete on the basis of entry examinations to other university-level schools. These schools have well-recognized reputations and students try to enter the best they can. Next to the Moscow University come the Moscow Electro-technical Institute, the Moscow Energetics Institute and Leningrad University.

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(2) Middle Technical Schools

- (a) "Primary school students who do not qualify for university training and leave the primary schools after the first seven years or later (by their own preference or in accord with the judgment of training authorities), and the students who entered a university-type school and failed to meet the requirements, may continue their technical training in special intermediate technical schools. Such schools are established and controlled by the Ministry of Education, other Ministries and special electronics institutes (there was one such school at Fryazino called Cholkovo Technical Intermediate School). In general, the training period is seven years of which three years are normally preparatory education years spent in the primary school and four years which must be spent in the technical school.

(b)

some text books at the Fryazino Cholkovo school were terrible. Many of these were German text books translated from German and most were too highly scientific in my opinion for training of technicians. No shop or laboratory facilities are available in these schools and no practical training is provided for the students. The students, however, work hard and willingly and their technical book knowledge is much higher than that of a German technician or mechanic. Graduates of middle technical schools have to go to such institutes as Cholkovo for practical training and usually require one to three years of on-the-job training to be useful. Essentially, therefore, the intermediate technical training is that of the university level somewhat simplified. this system is not the result of specifically planned government program, and might have resulted from a general shortage of laboratory equipment which limited allocation of such equipment for formal school use.

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- (c) "[redacted] the lack of practical experience of Soviet technicians and mechanics should not be used to derive a false impression of the capabilities of the Soviet electronics technician or mechanic. It is much easier to make a good practical technician out of a theoretician than the other way around.

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(3) University Level Schools

- (a) "[redacted] the entrance examinations to Soviet universities and university-level technical schools are quite hard, that of the Moscow University actually being a 'tough' one. The purpose of these examinations is to determine special aptitudes of the candidate-students and to select the best ones for specific professions. Therefore the rejection rate of the entrance candidates by the best schools is very high (only about a third of those qualified by good records in the primary schools and desirous of entering Moscow University succeed in passing the entrance examinations).
- (b) "The normal duration of university education is eight semesters, though recently /1951-52?/ there was talk about extending this to ten semesters. After four or five semesters the students are given preliminary tests to determine their aptitudes and rate of progress. Those who do not stand up to the required norms are dropped and are given opportunities for intermediary technical education and become technicians, mechanics, etc. After eight semesters a final and comprehensive examination is given to rate the individual for his future academic education and job assignments. Most of the students receive financial support from the government, roughly equivalent to a salary of an engineer. These students, however, must progress satisfactorily and pass all tests, and all those subsidized by the government are assigned, without regard to their wishes, to a position and location determined by the government for a period of two to three years. Since this assignment is determined to a large extent by the student's examination grades and general progress in studies (the best are assigned to the best and most important institutes like the Svetlana or Rusmanovsky Institute /sic/; the worst go to Siberia and other remote and hard-to-endure places), all students generally work very hard and leave their educational institution well trained in subjects offered. The training, as already mentioned, is strongly theoretical and involves no laboratory or shop experience [redacted]. Different titles are bestowed upon the graduates by the university training schools. The Moscow University gives the title of 'scientific worker,' the Moscow Institute offers the title of 'engineer.'
- (c) "By far the best university is Moscow University. It is every student's wish to be able to enter it. It offers the best training and best opportunities after graduation. [redacted] some professors

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of the Moscow University and thought them to be of the same educational level as the best of German professors. Among them are professors who studied in Germany (under Professor Sommerfeld), and some in England. The educational level of their studies was comparable to that of Professor Sommerfeld.

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There were many students in Fryazino from Moscow University. [redacted] very capable, and good material for first-rate engineers, upon acquiring practical experience. The Moscow University has recently completed a new building for lectures and for dormitory use for students in natural sciences, chemistry and physics. It is very beautiful and modern. The present capacity is around 20,000 students, more than half of whom work in the field of natural sciences.

- (d) "Next to Moscow University, the most desirable schools were the Moscow Energetics Institute, the Moscow Electrotechnical Institute and other specialized institutes in Moscow. These might account for perhaps 5,000 students in electrotechnical and physics fields. The graduates of these schools [redacted]

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[redacted] were a very capable lot of engineers. Graduates of Kiev, Kharkov, Gorky, Minsk and Odessa passed through or worked in Fryazino. On the basis of personal observations, [redacted] graduates from the Ukrainian universities in Kiev and Kharkov to be of a high educational level and very brilliant; however, those from Odessa were of an average caliber [redacted]

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[redacted] the educational level of the Leningrad University and Institutes is high.

- (e) "In addition to these outrightly educational institutions, an important phase of Soviet efforts to improve their engineering forces is the systematic creation and extension of technological schools which are part of on-the-job training of research development and production institutes. Such schools are built and maintained by the Ministries responsible for these institutes. For instance in Fryazino there was a school for engineers who had already completed the normal engineering education and wanted to continue their studies either to improve their general engineering knowledge or to prepare themselves for advanced degrees. Advanced mathematics, physics and technology plus laboratory work were subjects in these schools, and the teaching staff consisted of the best specialists available at Fryazino and of some Moscow University professors working as consultants to the Fryazino Institute (for a special consultative fee which is always an important inducement in the USSR). There were some 35-40 students in this school. They attended formal lectures two days a week, and spent four days in the laboratories. The course lasted three years and only the best and most promising engineers were chosen for the school by the director of the Institute. Only a few of the engineers graduated from the school [redacted]. The matriculation consisted of an examination before the scientific council composed of the leading men of the Institute and professors of the Moscow University. Since this was more in the nature of a preparatory school for possible aspirants for the 'candidate' and doctor degrees, no degree or title was offered. The graduates, however, received an increase in their base salary by an amount commensurate with their progress and proven aptitudes.

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(g)

There were some Polish engineers around Moscow.

these were Soviets of Polish extraction who had lived in the USSR for many years. There were in Moscow, in 1951, some 300 German students, most of them from East Germany. There did not appear to me to be any system (in regard to field of interest) in the selection of the students. Many of them did not speak Russian and had to attend 'special linguistic training.' All appeared, however, to be capable students, perhaps the best available. These German students moved freely, without the restrictions on the German technical specialists, and received a salary of 800 rubles. On the other hand, some 200 Soviet students were supposed to have gone to East Germany for education.

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(4) Advanced Degrees-'Candidate'

(a)

" the Soviet degree of 'Candidate' is equivalent to the western PhD or similar degrees. It is an academic degree awarded by the high educational institution to a scientific worker or engineer in recognition of his superior and thorough knowledge in his special field, familiarity with the general state of the art in the general field of his endeavors, and as a result of an examination which involves a series of oral tests and a favorable review of an original theoretical work prepared specially for this purpose. In this, the procedure and requirements are not much different from those of the western nations. In two important aspects differences exist: the Soviet aspirant for the 'Candidate' degree does not work with the educational institutions granting his degrees but does all his work in his professional organization or institute, and unlike in the West, in the USSR the decision to seek the degree does not rest with the individual but is a result of a careful selection of the best material for the aspirant which is done by professionally qualified authorities. The ratio of 'Candidates' to the total number of engineers is somewhat lower in the USSR than the corresponding ratio of PhD's in Germany. Thus, in Fryazino, there were only six or seven 'candidates' and one aspirant

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(b)

"Every Soviet engineer aspires to acquire the 'Candidate's' degree primarily because of the increase in his rate of pay and other financial benefits that accrue to the 'Candidate.' The decision to become an aspirant is not his. The recommendation must come from his superiors, it must be approved by the chief of his organization and must be further concurred in by the high educational institution which is to award the degree. The program of his work and his thesis also require the approval of the chief of his organization and of the educational institutions. His progress is carefully supervised and guided by a group of professors and instructors of the degree-awarding university or technical school, and if not deemed satisfactory can be terminated by the school or by his own institute.

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- (c) "The minimum requirement for becoming an aspirant in engineering is three years of satisfactory engineering performance. The normal period for aspirants' work is three years. During this period the aspirant is officially permitted two days a week off from his normal engineering duties: one day for home study and one day for his 'aspirant's activities' such as consultations with professors, work on his thesis, etc. Though his regular salary is decreased by the deduction from his pay for these two days, he receives a payment for his 'aspirant' work from a special government fund which is almost as much as the deductions from his salary. 'Aspirants,' thus are assisted by the State to become 'Candidates.'
- (d) "An 'aspirant's' thesis reflects his interest and professional capabilities. It also reflects the current technical problems and interest of his institute. If the thesis is on a timely and important subject, he may be permitted to spend nearly all his time on his thesis, and benefit from the institute's facilities and professional assistance. An example is the case of Zeitlin, a Soviet engineer who did his 'aspirant' work at Fryazino and whose written thesis was on the subject of reflection phenomena in klystron tubes. Since the subject was UNCODED, considered one of the most important problems at Fryazino at that time, Zeitlin spent all his time on this problem and in addition benefitted from direct assistance from a number of Fryazino specialists. All 'Candidates' thesis are regarded as the professional institute's papers and are published by the institute as such. 25X1
- (e) "A fair fluency in one foreign language is required of the 'aspirant.' This is an indication of the general Soviet policy which assists technical specialists in becoming more proficient in foreign languages. Once every three years a State examination in foreign languages is conducted in every Soviet institute. A technical specialist who is fluent in a foreign language (oral, written or translation) receives a 10% increase in his basic pay. Fair fluency (reading and translation only, for example) commands a 5% increase. The maximum increase in pay can add up to 20%. The present general language preferences among Soviet engineers are English and German (in the order of priority), though some Soviet engineers substitute French for German. Oriental languages apparently do not appeal to the Soviet technical specialists at present. do not believe that any special pressure comes from the Government in regard to the choice of languages, and the preference for English is the result of the general Soviet interest in the use of the readily available American technical literature. 25X1
- (5) Advanced Degree--Doctor
- (a) "There is no Western degree equivalent to the Soviet Doctor's degree. Perhaps the closest to it is the German, infrequently used, degree of 'Doctor Habil.' The Soviet Doctor's degree is the highest academic degree awarded. It is not an honorary title, requires a good deal of preparatory work and is awarded quite infrequently. There were no Doctors at Fryazino, excepting Dr. Babat who was a consultant to the institute. There was one man who received the degree subsequently. 25X1
- (b) "The degree is not awarded by an educational institution, but by a special permanent commission consisting of representatives of the Government, the Academy of Sciences, high educational institutions and professional organizations. Such special commissions exist for each man's field of science.

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(c) "There is no fixed pattern for the issuance of the Doctor's degree. [redacted] there is a minimum requirement that before applying for this degree one must be a 'candidate' for two to three years. There are no other special requirements or restrictions and one might become a Doctor at any age. After a 'candidate' has produced several original papers (four to six, or more) in his special field, he may coordinate this work with his assessment of the general world-wide state of the art in his field and prepare an outline of one great project which in his opinion might justify the submission of the request for Doctor's examination. He might then discuss this project with the chief of his institute, and with his concurrence, with the members of the examination commission. Provided there is a general consensus that the project is worthy of being used as a basis for the Doctor's examination, he then may go ahead. When it is believed that he is within half-a-year or a year of being ready to take the Doctor's examination, his institute releases him from other duties to permit him to get ready for the examination. During this period his salary is paid out of special funds provided for such purposes.

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(d) "During this preparatory period the 'candidate' keeps in touch with individual members of the examination commission and if the commission, and it's chairman, feel that he will pass the examination he is scheduled for it. Otherwise he may be advised to postpone his examination, or perhaps even drop the idea. The fact that he is advised to take the examination does not mean necessarily that he will pass it. The reason for this, is the examination is public and his general competence and his paper (previously published and open for discussions in technical literature) can be questioned and criticized not only by the members of the examination commission but also by outside qualified specialists.

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(e) "A good deal of financial benefit accrues to the 'candidate' who receives his Doctor's degree. His base salary is doubled automatically, he receives better living quarters and is available for consultative fees. Socially and professionally he belongs to a privileged group.

(f) "There are no honorary Doctor's titles in the USSR.

(6) Military Technical Education

(a) [redacted] It must in general follow the pattern of the civil education system and must be effective as Soviet technical officers sometimes show a college level of technical knowledge. Soviet Generals are superior technically to the German Generals. Their technical and scientific education is better and at times they show a remarkable grasp of involved technical problems.

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(b) "In order to compensate for the generally low level of education (most of military personnel of low rank have only the four-year compulsory education) those chosen for non-commissioned and officer's military courses receive special training in military schools.

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There is a growing tendency to lift the education level of Soviet military personnel. In 1951, for example, a law was passed requiring that officers marry girls with the minimum of five years of schooling.

(7) Women in Technical Fields

- (a) "In general, [] the participation of Soviet women in science and technology is the result of propaganda and severe living conditions which force women into earning money. 25X1
- (b) "As the result of these reasons, and particularly the drive to enlist women into technical activities during the war, some 40% of technical workers in the USSR are presently women. This is many times the ratio of women in technical fields in Germany. Shortly after the war some 80-90% of the students were women. [] presently /September 1953/ it might amount to perhaps 40% [] 25X1
- (c) "There appears to be neither discrimination nor feeling against women in technical and scientific activities and they are known to be at all levels from mechanics to doctors. There was a very capable woman named /Inu/ Vogelsson at Fryazino. She is a highly qualified scientist and technologist and is a member of the Svetlana group.

(8) Education Facilities

- (a) "The educational facilities at all school levels vary from 'very good' (as in Moscow University) to 'very poor' (as appears to be the case with Odessa University, for example). Books and reference works are generally available, teachers and instructors appear to be capable. Shop and laboratory facilities have been scarce. This, however, might change as the result of the clearly awakened recognition in technical institutes of their importance.
- (b) [] 25X1

(9) Stalin Prize

- (a) "Stalin prizes are a powerful inducement to progressive improvements in the general scientific and technological growth in the USSR. The scientific prestige of the prizes []. For instance, a 'Candidate's' degree is worth much more than a Stalin prize. However, it gives a man a high social prestige and is apt to serve him in a 'tight spot' with the law-enforcing agencies. There was a case of a Moscow professor who owned a private automobile and liked to drive it, although he did not know all the traffic regulations or did not care to obey them. Ordinarily, four traffic violations should result in the suspension of one's license. The professor should have had his license suspended at least 10 times, but he suffered no punishment because he was careful to show his Stalin prize certificate with his driver's license. 25X1

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- (b) "The basic importance of the Stalin prize is due to its recognition of outstanding technical (or other) accomplishments in terms of money, which means comfort of life in the USSR. The salaries in the USSR are based on the level of specialized training, degrees and proficiency in foreign languages. The individual performance at different grades varies considerably, and adequate methods to recognize these have yet to be developed by the Soviets.

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Stalin prizes were established mainly to provide legally, and in a well-advertised manner, the recognition of the outstanding accomplishments of Soviet scientists and technologists.

- (c) "Stalin prizes are also used as a special tool of the political leaders of the Soviet Government to reward scientists and technologists for their political reliability. Although the Soviets were careful not to alienate the specialists in such important fields as electronics by political pressure, they developed in the Stalin prize a method of rewarding those who think and act correctly.

(10) Soviet Management of Electronics Manpower

- (a) "Although the USSR has plentiful manpower, in the field of electronics they were faced, after the war, with the most critical shortage of adequate and properly-trained manpower at nearly all levels of scientific and technological activities, and particularly in the 'middle class' of engineering-application and production engineers. Although this shortage has been remedied to a remarkable extent, the Soviets have and will continue to have the problem of sufficient personnel for their ambitious program of beating the West in its strongest field, science and technology, and doing it in the shortest possible time. The problem of manpower management, therefore, has been a very pressing one. in their efforts to solve the problem the Soviets have developed management mechanisms and procedures which have proven very effective under their own conditions, and some aspects of which are of such general value that they are worth using anywhere. For example, the basic concept used by the Soviets in the management of their projects and personnel is being adopted with success by the Telefunken Company in West Germany.

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- (b) "This basic principle, in my opinion, is the concentration of effort on the most important aspects and right from the start. The mistake usually made in the West is that the effort at the beginning of any project, no matter how important, is not intense enough. The project, or idea, is stated in general terms and assigned to an individual or a small group of these to start it rolling. As the scope, full ramifications and requirements of the project are clarified and work gets underway, additional personnel, facilities and efforts are recruited, and so it goes until the project reaches its maximum stage of activities, generally close to its culmination, when the maximum of effort and facilities is required. Several fundamental things are wrong with this approach. The growth of requirements for manpower and facilities with the development of the project is not easy to meet because of the conflict of similar projects; since the supply of qualified manpower is

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not inexhaustible in any country. The pressing need for new personnel might result in the recruitment of inferior personnel at the time when experts are desired, and upon the termination of the project there is a large dispersal of specialists, who are at the peak of their interest in the project, to other duties and projects, perhaps unrelated to this interest. This has been the general experience in Germany before, during and after the war.

- (c) "The Soviet system, at least in principle [redacted] forces the greatest concentration of effort at the beginning. In the USSR the action on the project is not initiated nor authorized until a complete plan covering details and technical aspects, manpower, facilities, cost and time schedule, is carefully prepared, reviewed, reassessed and approved by all Government agencies concerned and interested. The project approval carries with it automatically the allocation of all required facilities, manpower and authority. There are several good points which can be raised in favor of this system: no project is undertaken which cannot be completed because of the lack of proper facilities, knowledge or manpower; although failure of the project is possible, the responsibility for the basic failure cannot be assigned to any one individual or group of these since the project has been reviewed by all interested organizations, agencies and personnel. [redacted] this is very important in the USSR as the fear of personal punishment for project failure was strong among Soviets immediately after the war, and is nearly extinct now). If the best specialists are not at hand, second or third string people can be used and retrained for specific jobs, and/or the specific duties can be recast to fit them. As the project progresses the manpower generally useful in the early stages of the project is released for similar duties elsewhere.
- (d) "The following is an example of the manner in which Soviet research and development projects are handled. A basic idea of a project might be postulated by an individual or might come as a result of a request from higher authorities. The idea is reviewed at the institute where it is originated, and, if considered worthy of action, is submitted to a preliminary assessment in a discussion of all interested elements by the Ministry to which the institute belongs. At this meeting the specialist who originated the idea or who is interested in its handling presents the sketch of the project in which he states the basic idea in as clear terms as he is capable of and proposes estimated and required effort, the extent of basic research, development, etc, required manpower, facilities, literature, special tools and cost. The sketch project is inspected closely by the Ministry specialist in regard to the adequacy of the preliminary assessment of the concept, methods of approach and estimates. If this assessment is positive, the project is turned over to a specialist who will be responsible for it, to prepare a detailed and thorough program covering all elements of the project. The result is a detailed and complete plan for action on the project. It segregates

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all theoretical work in the so-called technical project; it lists all special requirements in regard to its development aspects, its laboratory and shop work, the needs for special tools, testing devices, raw material, buildings and other facilities, and manpower. No actual work is done at this stage, and no research of a theoretical, experimental, or application nature is permitted at this stage unless it is indispensable for the clarification of the basic concept of the project and is within the capability of the project engineer alone. The project as a whole is then submitted for close inspection to the technical-scientific committee of the interested institute which is a standing body (every important institute has such) consisting of its leading specialists. At Fryazino, the committee included men such as Zuzmanovsky, Feodosiyev, Kostikov, Miss Vogelsson, etc. It is the responsibility of this committee to pass on the technical validity, feasibility and accuracy of the project, its premises and its goals. The committee might, and frequently does, call for opinions of outside specialists. Should the committee assess the project to be sound, valid, timely and desirable, it may approve it; whereupon, the project becomes a part of the institute program and its responsibility. Should the committee find the fulfillment of the project to be outside its capabilities, i.e., (specialized needs for competence available elsewhere, for particular hard-to-get facilities, etc), it might enter into an agreement with other institutes for mutual support or refer it to higher authority. Only upon the completion of this stage of the preparatory work does the project become an operational undertaking and its implementation proceed as planned.

(e) " [redacted] the above procedure is neither as complicated or cumbersome as it may appear. It does not need to take a longer time than the normal handling of such projects in Germany. It is not regarded as a commitment to be literally adhered to at the threat of personal punishment. Failure to meet the progress schedule by 10, 20 and even 50 per cent is excusable for valid reasons. (For valid technical reasons a project can be extended four or five times. The example of this was the 3-cm magnetron development at Fryazino which was to be completed in 1947 but on which work was still going in 1951.) However, slacking down or 'wishy-washy' handling of the project is not tolerated and might result in a re-assignment of the responsible personnel. The system is effective in the USSR as the Soviet electronics progress since the war can attest. The experimental use of this by Telefunken so far has also proven successful.

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(f) "The Soviet need to exploit all its manpower, including mediocre and young graduates, in their program, is not only manifested in their over-all mechanism for handling projects. Attempts are made to have a good cross-section of their personnel in every group. A leader

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of a group might be a high caliber man, a Svetlana engineer or an engineer graduated from the Moscow University, but his group is made up of specialists of all ages, competence and quality. This might reduce, to some extent, the immediate effectiveness of the best men in the group, but it raises the contribution, and in the long run, the quality and competence of all its members.

- (g) "The Soviets are a purposeful and stubborn people, and above all, realists. They have given much thought to the problem of increasing their scientific and technological capabilities, and they progressed far in the relatively short period since the end of World War II. They recognize that the goal has not been reached yet, that it might take a long time to reach it, and that hardships and even set-backs might have to be overcome to do so. They are ready to face them. The general attitude of the Soviets may be summed up somewhat as follows

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'You Germans are ahead of us and you believe you will remain ahead. Your master mechanic of 30 years' experience has in fact had some 50 years of study and training, and they are very good. Ours have had only a few years and they are quite good. How good do you think they will be 30 years hence?'"

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